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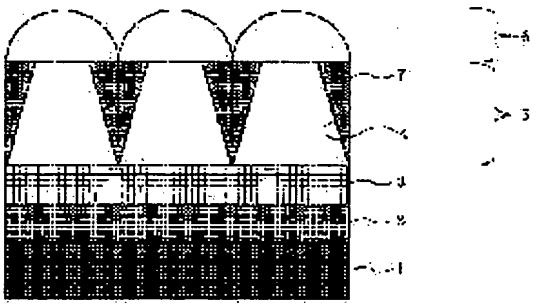
(54) EL ELEMENT AND DISPLAY USING THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an EL (electroluminescence) element efficiently taking out light to the device outside and to provide an EL display improving the brightness and reducing the power consumption.
SOLUTION: This EL element and the EL display are so constituted that a condensing structure substantially narrowing a light emission area is provided between a light emitting layer and a whole reflection suppressing structure and, at least, the refractive index of the condensing structure out of materials constituting the whole reflection suppressing structure and the condensing structure is more than the refractive index of the material constituting the light emitting layer.



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CLAIMS

[Claim(s)]
[Claim 1] It has the transparent electrode prepared in the optical drawing side side, and the back plate which countered said transparent electrode and was prepared. It is the EL element equipped with a luminous layer between said transparent electrodes and said back plates. Total reflection control structure is prepared in said optical ejection side side, and the condensing structure of extracting luminescence area substantially is established between said luminous layer and said total reflection control structure. The EL element to which the refractive index of said condensing structure is characterized by being more than the refractive index of the ingredient which constitutes a luminous layer at least among the ingredients which constitute said total reflection control structure and said condensing structure.
[Claim 2] The EL element according to claim 1 characterized by said condensing structure having a reflector to component side inboard.
[Claim 3] Said condensing structure is an EL element according to claim 1 characterized by being the taper structure where the area of the field by the side of irradiation appearance is small compared with the area of the field by the side of said luminous layer of said condensing structure.
[Claim 4] The EL element according to claim 1 characterized by said total reflection control structure being convex lens structure or spindle-like structure.
[Claim 5] The EL element according to claim 1 characterized by preparing the light absorption member in the perimeter of the field by the side of the irradiation appearance of said condensing structure.
[Claim 6] The EL element according to claim 5 characterized by arranging the ingredient which constitutes said two or more condensing structures in said light absorption member, and arranging said light absorption member face-to-face [by the side of said each irradiation appearance of two or more of said condensing structures].
[Claim 7] Both the ingredient which constitutes said total reflection control structure, and the ingredient which constitutes said condensing structure are an EL element according to claim 1 to which a refractive index is also characterized by the same thing with the same ingredient.
[Claim 8] The display characterized by equipping claims 1-7 with the EL element of a publication.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to EL (electroluminescence: Electro Luminescence) component and the display which used the component.
[0002]
[Description of the Prior Art] An organic EL device is a light emitting device which operates by pouring in an electron and a hole (electron hole) from an electrode to an organic fluorescent substance, and exciting an emission center with those recombination energies.
[0003] Although the structure of an organic EL device is the sandwich structure which sandwiched the luminous layer with the electrode, it is possible by making one [at least] electrode of an electrode into transparence to obtain a field-like light emitting device.
[0004] The mimetic diagram which explains the configuration of a very easy organic EL device to drawing 12 is shown. In this mimetic diagram, although only the back plate, the organic luminous layer, the transparent electrode, and the glass substrate are indicated, the laminating of many thin film layers with various electronic transportation layers, hole transportation layers, etc. is carried out, and they consist of actual components. By carrying out the seal of approval of the electrical potential difference between a back plate and a transparent electrode, luminescence takes place within an organic luminous layer, and it has composition which takes out the light from a transparent electrode side to the component exterior.
[0005] Although the light which emitted light by the organic luminous layer is injected through a transparent electrode or a glass substrate in the component exterior (for example, inside of air), the refractive indexes of the ingredient generally used for an organic luminescent material, a transparent electrode, and a glass substrate differ. Therefore, in the interface which the 1st ingredient (refractive index: n1) which has a different refractive index, and the 2nd ingredient (refractive index: n2) touch, the optical ejection loss by Fresnel reflection arises. Fresnel reflection can be expressed using the refractive index of an ingredient, for example, when it is vertical incidence, it is expressed by the following formulas.
[0006]
R= {[(n1-n2)]/[/} (n1+n2)] rate of 2R:Fresnel reflection n1: -- refractive-index n2: of an ingredient 1 -- total reflection happens about the light which is more than a total reflection include angle, and carried out incidence to the refractive-index pan of an ingredient 2 to the incidence side ingredient (refractive index: ni) when the refractive index of a injection side ingredient (refractive index: ns) was low (i.e., when it is ni>ns) (drawing 13). Critical angle thetac to which total reflection happens is expressed by the following formulas.
[0007] thetac=arcsin (second/ni)
thetac: The refractive index ns of a total-reflection critical-angle ni:incidence side ingredient: Total reflection happens about the light which carried out incidence at the bigger include angle than refractive-index critical angle thetac of a injection side ingredient, and if absorption of an ingredient is disregarded, reflection will take place 100%. Therefore, it becomes a big loss when taking out light to the component exterior. The optical ejection effectiveness actually taken out outside when a glass plate is used for a substrate becomes about twenty or less percent.
[0008] There are some examples of a report about the technique of improving the optical ejection effectiveness to the component exterior.
[0009] For example, the proposal which prepares a micro lens on a component substrate and improves the optical ejection effectiveness to the component exterior is made (drawing 14). (for example, patent No. 2773720) In order to control effectively the total reflection produced in an interface with air, it is required to

have a sufficiently big diameter of a lens to luminescence area. However, in the conventional configuration, since it was difficult to prepare the lens of a path big enough to the luminescence area in a component, sufficient total reflection depressor effect was not able to be acquired. It is disadvantageous to provide a sufficiently big lens to pixel area for the component application which aimed at implementation of pixel size with an especially high definition display application etc., in view of points, such as a physical interference of the micro lenses between pixels, and densification of a pixel.

[0010] Although the proposal of the structure which used the aggregate of an optical fiber as the substrate for the purpose of offer of the component which it is efficient and can take out to the exterior luminescence of the organic EL device which penetrates a substrate in JP,2000-260559,A was made, since the optical fiber was used as a member aiming at the guided wave of light, opening area became small and there was a trouble that a quantity of light loss arose.

[0011] Moreover, in JP,2000-284726,A, luminous intensity in a specific direction is enlarged, it is the purpose which offers the display which can use light with an efficient and large angle of visibility, and the proposal of structure with a directive member like the resonator structure which was in x directions and the direction of y with the multilayered film structure of having periodic refractive-index distribution, and a dispersion member like a micro-lens array is made. Although the angle-of-visibility improvement was aimed at in the example by providing as structure for strengthening directivity, such as resonator structure, and having dispersion members, such as a micro lens, it could not be difficult to have a micro lens big enough to luminescence area, it was not able to take out, and was not fully able to raise effectiveness.

[0012] what is provided in order that this high refractive-index section may make substantial luminescence area small although it is the purpose which makes a viewing-angle dependency small and gives an indication high brightness by high brilliance in JP,7-37688,A and there is a proposal using the substrate which has the column-like high refractive-index section -- it is not -- in addition -- and the structure which controls total reflection is not provided, either.

[0013] In order to realize EL display which suppresses reflection of outdoor daylight and has good contrast in JP,11-265791,A, the structure or island structure of having the light transmission hole which reflects the intrinsic light and absorbs outdoor daylight was proposed, but since there was no device for controlling the total reflection produced in the interface of a substrate and air, it was inadequate for taking out light efficiently.

[0014]

[Problem(s) to be Solved by the Invention] this invention person noted controlling the total reflection produced in the interface of a component and air in view of the above-mentioned trouble. Moreover, the refractive index of the refractive index of an organic luminous layer and the medium passed in case the light in which the organic luminous layer emitted light from the organic luminous layer to the light emitting device exterior goes away was observed.

[0015] This invention makes it a technical problem to take out light effectively to the component exterior, and to realize the high visibility as a display.

[0016]

[Means for Solving the Problem] Therefore, this invention has the transparent electrode prepared in the optical drawing side side, and the back plate which countered said transparent electrode and was prepared. It is the EL element equipped with a luminous layer between said transparent electrodes and said back plates. Total reflection control structure is prepared in said optical ejection side side, and the condensing structure of extracting luminescence area substantially is established between said luminous layer and said total reflection control structure. The EL element to which the refractive index of said condensing structure is characterized by being more than the refractive index of the ingredient which constitutes a luminous layer at least among the ingredients which constitute said total reflection control structure and said condensing structure is offered.

[0017]

[Embodiment of the Invention] This invention relates to an EL element (electroluminescent element: :Electro Luminescence component). Although this operation gestalt mentions and explains an organic EL device as an example like the after-mentioned, an inorganic EL element is sufficient as this invention.

[0018] Drawing 1 is used and explained below.

[0019] Drawing 1 is the typical sectional view of the organic EL device concerning this operation gestalt.

[0020] As for a back plate and 2, in drawing 1 , 1 is [an organic luminous layer and 3] light absorption ingredients with this operation gestalt in a transparent electrode and the supporter material to which in 4 condensing structure and 6 support total reflection control structure, and, as for 7, a light reflex ingredient

and 5 support condensing structure from the outside. In addition, in drawing 1 , a fundamental configuration is not shown and it does not restrict to this configuration. Even if layers later mentioned next to the organic luminous layer 2 as a part of organic luminous layer 2, such as an electronic transportation layer and a hole transportation layer, exist, it is satisfactory in any way.

[0021] About an organic luminous layer, it is called for that a high quantum yield is acquired by the solid state, that membrane formation nature is good, and that carrier transportability is high. In the case of a low-molecular ingredient, in the case of vacuum heating vacuum evaporationo and a polymer ingredient (polymeric materials), as the production technique, the applying methods, such as DIP coating and spin coating, etc. are mentioned, for example. (Refer to the electronic intelligence display handbook (Baifukan) p.407-p.408 for an example of a polymer ingredient.) As an example of a typical organic low-molecular luminescent material again A tris (8-quinolinolato) aluminum complex (Alq3), a bis(benzoquinolinolato) beryllium complex (BeBq), Eu (DBM)2 (Phen) which is Eu complex, and DPVBi which is a JISUCHIRIRU derivative -- being shown (seeing the electronic intelligence display handbook (Baifukan) p.405), of course, even if it uses ingredients other than this as an organic luminescent material, it is satisfactory in any way. Moreover, an ingredient with a high fluorescence quantum yield is used as a dopant, and is used for improvement in the modulation of the luminescent color, color mixture, and luminous efficiency. as an example of a typical dopant ingredient -- a coumarin 6, rubrene, Quinacridone, and DCM-1 -- being shown (seeing the electronic intelligence display handbook (Baifukan) p.406) -- use of ingredients other than this is not restricted with a natural thing.

[0022] Although the substrate was not illustrated in drawing 1 , a substrate is a base material which supports the organic EL device of drawing 1 . Although used as an anode plate electrode on a substrate (equivalent to the transparent electrode 3 of this operation gestalt), there is an indium-stannic-acid ghost (ITO) as an example of representation, and it can be used as a transparent electrode, and it can produce by vacuum deposition or the spatter.

[0023] The small magnesium of a work function, a lithium, sodium, a potassium, calcium, magnesium, aluminum, an indium, silver, lead, tin, chromium, etc. can be used for cathode (equivalent to the back plate 1 of this operation gestalt) as a metal simple substance or two or more alloys. Moreover, cathode may be a configuration much more or may be a multilayer configuration.

[0024] Moreover, although not illustrated, the electronic transportation ingredient and hole transportation ingredient which bear the role which pours in an electron and a hole (electron hole) with sufficient balance are used. In that case, an electronic transportation ingredient and a hole transportation ingredient may be another layers which were contained in the organic luminous layer 2, or have been arranged next to the organic luminous layer 2. As an electronic transportation ingredient, generally the arylamine derivative was used and PBD, TPhen, and OXD and TAZ were shown as a typical electronic transportation ingredient (see the electronic intelligence display handbook (Baifukan) p.407). Moreover, as a hole transportation ingredient, 1, 2, 4-OKISA diazole derivative, 1 and 3, 4-triazole derivative, and the phenanthroline derivative are used, and, generally TPD, alpha-NPD, TPT, and Spiro-TPD were shown as a typical hole transportation ingredient (see the electronic intelligence display handbook (Baifukan) p.406). Although the configuration which takes out light from an anode plate side as an example was explained here, of course, you may be the configuration which used the optical ejection side as cathode.

[0025] The condensing structure 5 has the structure (configuration) which makes substantial luminescence area small. Here, taper structure was raised as an example. That is, this taper structure has the structure where the cross section of opening becomes small, toward the direction of optical ejection from the organic luminous layer. For example, although it is applied to the structure which makes small luminescence area with substantial cone configuration, square drill configuration, multiple drill configurations, or these frustum configurations, of course, it does not limit to these configurations. Moreover, as for the side face of the ingredient of the side which light penetrates in taper structure, it is desirable to consist of reflectors. In addition, this reflector may be the thing of the previous light reflex ingredient 4, and a reflector may be a field which consists of another member which could be formed in condensing structure 5 front face, could be formed in light absorption ingredient 7 front face which is supporter material, and was prepared between the condensing structure 5 and the light absorption ingredient 7.

[0026] Moreover, the refractive index of the ingredient of the condensing structure 5 is more than a refractive index of the organic luminous layer 3. Moreover, the refractive index of the ingredient of the total reflection structure 6 is more than a refractive index of the organic luminous layer 3.

[0027] moreover, although the refractive index of the organic luminous layer 3 and the refractive index of the ingredient of the condensing structure 5 are observed when the next door of a configuration 3 like the

component shown by drawing 1 , i.e., an organic luminous layer, is the configuration of being the condensing structure 5 immediately (or the refractive index of the organic luminous layer 3 and the refractive index of the total reflection control structure 6 are observed) What is necessary is just to design an organic EL device paying attention to one of refractive indexes, and the refractive index of the organic luminous layer 3, even if there are little condensing structure 5 and total reflection control structure 6 when another charge transportation layer is prepared between the organic luminous layer 3 and the condensing structure 5. In addition, the component of a configuration of that the component and this another charge transportation layer of a configuration of that this another charge transportation layer exists do not exist was also assumed, and the luminous layer is defined as the luminous layer which constitutes the EL element of this invention.

[0028] The total reflection control structure 6 has the structure which makes small whenever [to a component external medium / incident angle] in order to control at least signs 1, 2, 3, 4, 5, and 6 and the total reflection produced in an interface with the medium (for example, air) in the exterior of the component which consists of 7. For example, the structure of having a convex lens configuration and a spindle-like configuration is mentioned as an example. With this operation gestalt, although convex lens structure was mentioned in drawing 1 , about spindle-like structure, it mentions later.

[0029] Drawing 2 is a mimetic diagram to which the organic EL device of this operation gestalt expresses the condition that two or more arrangement was carried out, and the bird's-eye view of the organic EL device with which drawing 2 (A) possesses the total reflection control structure 6, and drawing 2 (B) are the mimetic diagrams which saw it from the total reflection control structure 6 side. As shown in drawing 2 (B), plurality aligns for every matrix and the total reflection control structure 6 (convex lens in this case) is arranged. Moreover, the total reflection control structure 6 is arranged on the light absorption ingredient 7. The round head of the continuous line illustrated by drawing 2 (B) is opening within the field of the light absorption ingredient 7 illustrated by drawing 2 (B), and is also a field by the side of the irradiation appearance of opening 5, i.e., condensing structure. Moreover, as for the round head of the dotted line illustrated by drawing 2 (B), the total reflection control structure 6 illustrates the profile of the field of the light absorption ingredient 7, and the touching field. As illustrated with a circle [of a dotted line], the field of the light reflex ingredient 7 and the touching field have the total reflection control structure 6 larger than the field by the side of the irradiation appearance of the condensing structure 5, and it is magnitude to the extent that the field by the side of the irradiation appearance of condensing structure is covered. The relation of the magnitude is clear also from drawing 1 .

[0030] In addition, even if the field where the total reflection control structure 6 touches the field of the light absorption ingredient 7 with the gestalt of this operation is larger than the field by the side of the irradiation appearance of the condensing structure 5, it is good also in the same magnitude. It is effective in the ability to be able to control effectively the total reflection which the rate of injection light increases from opening with angular distribution smaller than a total reflection include angle when large, consequently is produced in the interface of total reflection prevention structure and air, and, on the other hand, in the case of the same magnitude, there is effectiveness of the improvement in contrast by the effectiveness which controls the reflected light by the light absorption ingredient which is the supporter material prepared around opening.

[0031] The total reflection control structure 6 with convex lens structure (configuration), for example moreover, and the light injected from opening (irradiation labor attendant of the condensing structure 5) when the field where the total reflection control structure 6 touches the field of the light reflex ingredient 7 was larger than the field by the side of the irradiation appearance of the condensing structure 5 In total reflection control structure and an air interface, what serves as a small include angle from a total reflection angle increases. When it is effective in the ability to take out light to the component exterior effectively, and the total reflection control structure 6 is spindle-like structure (configuration) on the other hand and the field where the total reflection control structure 6 touches the field of the light reflex ingredient 7 is the same magnitude as the field by the side of the irradiation appearance of the condensing structure 5 While the rate of injection light which has the angular distribution below a total reflection angle according to spindle-like structure increases and being able to take out light to the component exterior effectively, it is effective in contrast improving according to the effectiveness which controls the reflected light by the light absorption ingredient prepared around opening.

[0032] Temporarily, in not establishing condensing structure of a taper configuration, the design which it cannot become difficult to control distribution whenever [radiation angle], and total reflection depressor effect by total reflection structure control structure cannot fully obtain, consequently is compatible in transverse-plane reinforcement and total ejection effectiveness becomes difficult. Moreover, when the

refractive index of the ingredient which constitutes condensing structure and total reflection prevention structure is lower than an organic luminous layer, it is distributed (radiation distribution the way which looked at the component from across looks brightly) whenever [radiation angle / by which distribution inclined toward the big include angle whenever / radiation angle / in a taper part].

[0033] It means that the way at the time of observing from across compared with the case where it observes from a transverse plane when it uses as a display looks brightly as for this. It is desirable that brightness does not change, even when it observes from which direction as a display. It is required to be a refractive-index member higher than the refractive index of the ingredient with which the condensing structure, the condensing structure, and total reflection prevention structure of a taper configuration constitute an organic luminous layer from the above reason.

[0034] Moreover, although this operation gestalt explained the member which supports the condensing structure 5 as a light absorption member The inside of the field of the supporter material (light absorption ingredient 7 of this operation gestalt) which condensing structure itself does not necessarily need to be a light absorption member, for example, supports the condensing structure 5, Surface treatment may be carried out in order give a light absorption function to the field of the side which supports the total reflection condensing structure 6 at least, to prepare another member (light absorption member) or to give a light absorption function for this field itself. It becomes the configuration that the point emitting light was surrounded by the light absorption member within one component with devising such light absorption.

[0035] Since a light absorption member is generally dark, and its contrast can improve within one component or it can protect with [by outdoor daylight] **, its contrast improves. And since high contrast can be maintained or it can protect with [by outdoor daylight] ** to luminescence from a mutual component also when two or more components are made to arrange, contrast improves.

[0036] Moreover, with this operation gestalt, the structure 5 condensing [optical] and the total reflection control structure 6 may be arranged with another object, or it may be arranged by one. Moreover, the same value is sufficient as each refractive index of the structure 5 condensing [optical] and the total reflection control structure 6, or it may differ a little.

[0037] (The 1st example) The schematic diagram of the organic EL device concerning the 1st example is shown in drawing 3 . This example possesses condensing structure and total reflection control structure like the organic EL device concerning the gestalt of implementation of previous invention. It designed so that the organic EL device of this example might be described below. Component size was used as 80-micrometer angle, and carried out the laminating of the transparent conductive ingredients (refractive index: n(ITO) = 2.0) 3, such as ITO, for the organic luminous layer which consists of organic molecules on the back plate 1 using a metal, and the other organic compound layers (refractive index: n(org) = 1.71) 2 on it further. Furthermore, the condensing structure 5 of a taper configuration was established on the transparent conductive ingredient, and the total reflection control structure 6 was further established on the condensing structure 5. The sum total thickness with an organic compound layer and other organic compound layers set thickness of 100nm and ITO to 100nm.

[0038] The ingredient of the condensing structure 5 of having taper structure is TiO2 (refractive index: n (TiO2) = 2.3). The light absorption ingredient 7 is formed by the surroundings of taper structure. Moreover, the light reflex ingredient 4 is formed in the interface of a light absorption ingredient and taper structure. As a light absorption ingredient 7, black plastic material etc. can be used, for example. Moreover, as a light reflex ingredient, they are metallic materials, such as gold, silver, and aluminum. And it is good also as a configuration which takes the dielectric thin film mirror structure which could use the light reflex ingredient which is this metallic material as a thin film material produced by technique, such as vacuum evaporationo, a spatter, and dipping, or carried out the laminating of a high refractive-index ingredient and the low refractive-index ingredients (for example, TiO2, SiO2, etc.) by turns, and produced the light reflex ingredient again. Moreover, in this example, taper structure was made into the truncated-cone configuration, and alpha= 25 degrees and height h of the structure were set to h= 30 micrometers for cone-angle alpha.

[0039] Moreover, the configuration of total reflection control structure was used as the convex type semi-sphere lens, and set radius of curvature r to r= 40 micrometers. The ingredient to constitute took the stuck arrangement which set to TiO2 (refractive index: n(TiO2) = 2.3), and made in agreement the core and optical axis of injection opening of condensing structure.

[0040] Comparison examination was carried out with the component which has a configuration using the conventional glass substrate about the transverse-plane reinforcement and the total ejection reinforcement in a component with the above structures. Becoming an index visible [transverse-plane reinforcement is how much bright when a watcher looks at a luminous organic EL device from a transverse plane, and], it is the

light-emission reinforcement injected in the direction of a normal over the field of an organic luminous layer, and it is all the optical reinforcement injected from the organic luminous layer in the component exterior (inside of air), and total ejection reinforcement is the integral value of the intensity of radiation in a total radiation include angle here.

[0041] The point which is in extension of the direction of a normal over the field of an organic luminous layer about transverse-plane reinforcement was made into the station, and it evaluated about the intensity of radiation in the station (distant place community) distant sufficiently distantly [organic EL device]. Moreover, the integral value of the intensity of radiation in the station in the distant place community to a total radiation include angle estimated total ejection reinforcement. Those results are shown in a graph and drawing 4 and drawing 5 show.

[0042] Drawing 4 is the conventional-type organic EL device (it was described as the "glass substrate") which constituted the organic EL device on the glass substrate, and the comparison graph of the transverse-plane reinforcement in the example 1 concerning this invention, and drawing 5 is a conventional-type organic EL device and the comparison graph of the total ejection reinforcement in the example 1 concerning this invention. It is the thing of an organic EL device with the structure which prepared the transparent electrode, the organic luminous layer, and the metal electrode on the glass substrate as indicated to be the conventional-type organic EL device which constituted the organic EL device on the glass substrate to drawing 12 . Moreover, an axis of ordinate is the reinforcement of arbitration. About transverse-plane reinforcement, one about 2.1 times the reinforcement of this was conventionally obtained about about 1.3 times and total ejection reinforcement as compared with the configuration as compared with what constituted the organic EL device on the configuration, i.e., a glass substrate, conventionally so that a graph might show. The angular distribution at this time is shown in drawing 6 . angular distribution is distribution of the intensity of radiation of whenever [each radiation angle], and it comes out. Intensity of radiation (W/steradian) is shown in the azimuth direction, and whenever [radiation angle] is shown in the radial direction. Consequently, the organic EL device which strong directivity does not have, either and has a large angle-of-visibility property is realizable so that it may improve compared with the former and transverse-plane reinforcement and total ejection light reinforcement may moreover be known from a big bias not being looked at by intensity of radiation from a transverse plane (equivalent to 180 degrees in drawing 6) in drawing 6 in about **45 degrees (it setting to drawing 6 and being the range of 135 degrees - about 225 degrees).

[0043] (The 2nd example) The schematic diagram of the organic EL device concerning the 2nd example is shown in drawing 7 . Moreover, a bird's-eye view and the schematic diagram of a front view are shown in drawing 8 . As for this example, configurations differ in that the organic EL device and the total reflection control structure 6 of an example 1 are spindle-like structure (configuration) unlike convex lens structure (configuration).

[0044] In addition, spindle-like structure (configuration) is prepared in right above [the] in the same magnitude as the opening side face of the condensing structure 5 by this example. It designed so that the organic EL device of this example might be described below. Component size was used as 80-micrometer angle, and carried out the laminating of the transparent conductive ingredients 3 (refractive index: n(ITO) = 2.0), such as ITO, for the organic luminous layer which consists of organic molecules on the back plate 1 using a metal, and the other organic compound layers 2 (refractive index: n(org) = 1.71) on it further.

[0045] Furthermore, the condensing structure 5 of a taper mold was established on the transparent conductive ingredient, and the total reflection control structure 6 was further established on the condensing structure 5. The thickness of the sum total with an organic compound layer and other organic compound layers set thickness of 100nm and ITO to 100nm. The ingredient which constitutes taper structure was set to TiO2 (refractive index: n(TiO2) = 2.3), and constituted the surroundings of taper structure from a light absorption ingredient. Moreover, in the interface of a light absorption ingredient and taper structure, it constituted from a light reflex ingredient. alpha= 25 degrees and height h of the structure were set to h= 30 micrometers for cone-angle alpha of taper structure.

[0046] Moreover, the configuration of total reflection control structure was made into the convex type cone configuration, set the base circle radius r to r= 26 micrometers, and made conic cone-angle beta beta= 50 degrees. The ingredient to constitute took the stuck arrangement which set to TiO2 (refractive index: n (TiO2) = 2.3), and made in agreement the core and optical axis of injection opening of condensing structure. The opening side radius of condensing structure [in / to the base circle radius of a this convex type cone configuration / this bottom surface part] is 26 micrometers.

[0047] Comparison examination was carried out with the component which has a configuration using the

conventional glass substrate about the transverse-plane reinforcement and the total ejection reinforcement in a component with the above structures. The comparison graph of transverse-plane reinforcement is shown in drawing 9 , and the comparison graph of total ejection reinforcement is shown in drawing 10 .
Consequently, about transverse-plane light reinforcement and total ejection light reinforcement, it is almost equivalent and checked that the ejection effectiveness which is not inferiority was realizable. On the other hand, with the organic EL device in an example 2, opening area has become about 23% of the component of a configuration conventionally, and this shows that total optical ejection effectiveness is not changing, even if luminescence area becomes 23% compared with a configuration conventionally. In addition, since the supporter material of parts other than opening consists of light absorption ingredients, the reflected light component from a back plate reduces it sharply. Consequently, an improvement of visibility and contrast is realizable.
[0048] (The 3rd example) A full color organic electroluminescence display is described as the 3rd example. The schematic diagram and transverse-plane schematic diagram of a cross-section configuration were shown in drawing 11 . A substrate 30, TFT31 which drives each pixel. The back plate for every pixel produced on TFT, the red luminescent-material layer 33, the green luminescent-material layer 34, the blue luminescent-material layer 35, a transparent electrode 36, the condensing structure 5, and the total reflection control structure 6 are established.
[0049] Since the optical ejection effectiveness to the component exterior was low, in order to realize a bright display with the conventional structure, there was the need of passing more currents to an organic luminous layer, therefore it was disadvantageous in the point of the life of power consumption or an ingredient. In order to realize a high definition display, the need of raising a degree of integration is in coincidence. If a degree of integration goes up, in connection with it, component size will become small, luminescence area will become small, and brightness will fall. Therefore, the light which came out of the organic luminous layer was wanted to take out to the component exterior efficiently.
[0050] In the organic electroluminescence display of this invention, light can be conventionally taken out efficiently compared with the thing of a configuration by providing total reflection control structure and condensing structure. Moreover, since it can provide after constituting an organic EL device, total reflection control structure and condensing structure cannot be based on organic EL device structure, but can be established. Consequently, the full color organic electroluminescence display which realizes high brightness, a low power, high visibility, and high color purity is realizable.
[0051]
[Effect of the Invention] As explained above, according to this invention, the EL display which can offer the EL element which can take out light efficiently to the component exterior, and improved a raise in brightness and low-power-ization to it can be offered.

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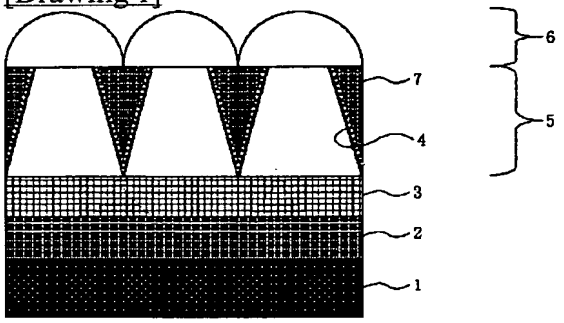
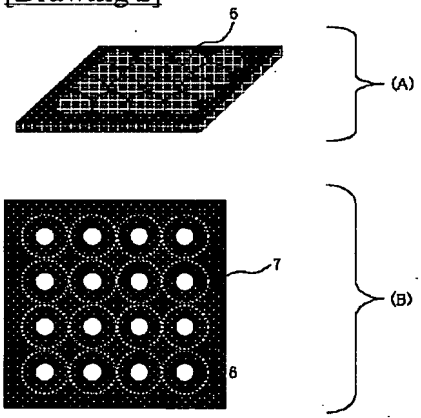
DRAWINGS

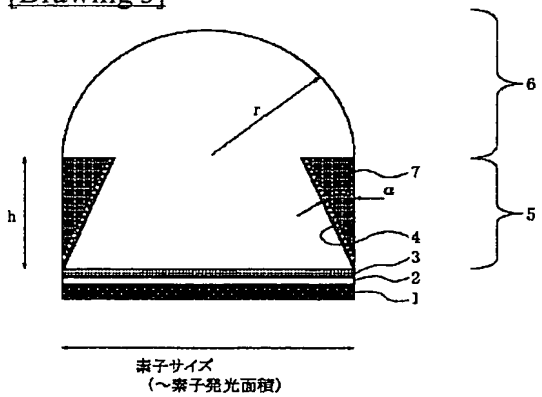
[Drawing 1]



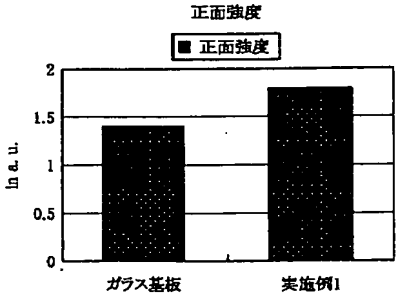
[Drawing 2]



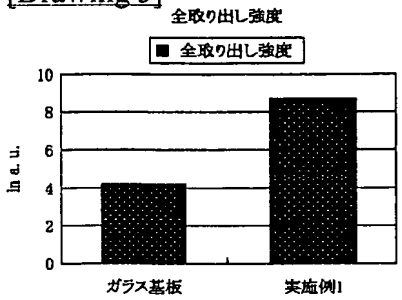
[Drawing 3]



[Drawing 4]



[Drawing 5]



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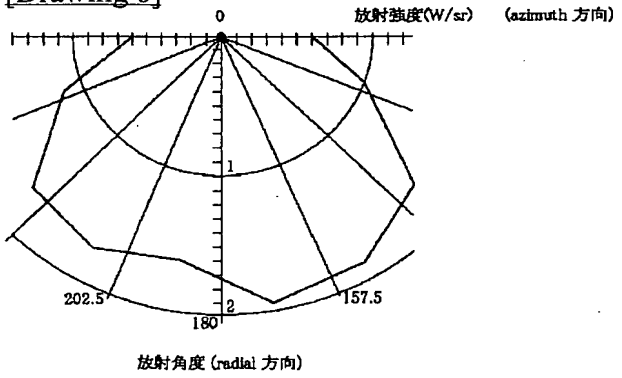
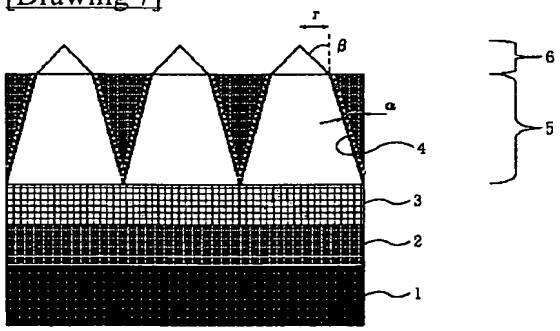


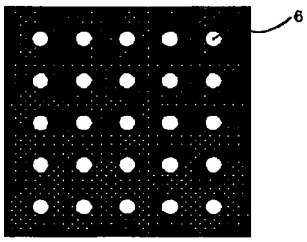
[Drawing 7]



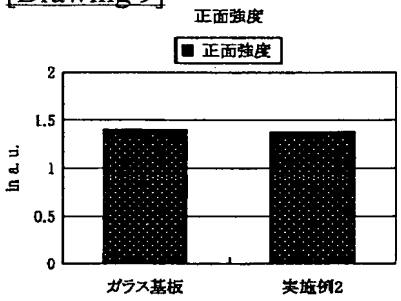
[Drawing 8]

(A)

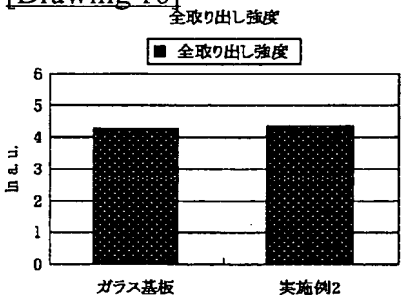
(B)



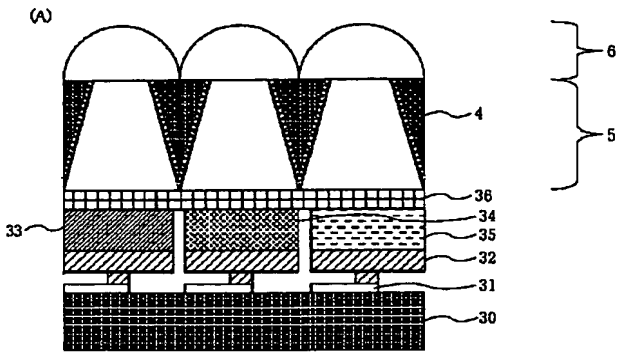
[Drawing 9]

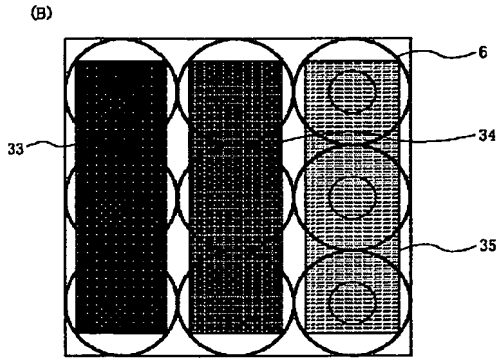


[Drawing 10]

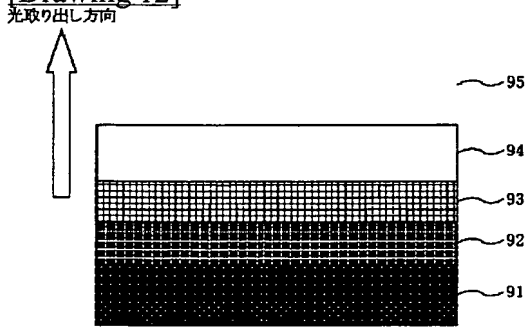


[Drawing 11]

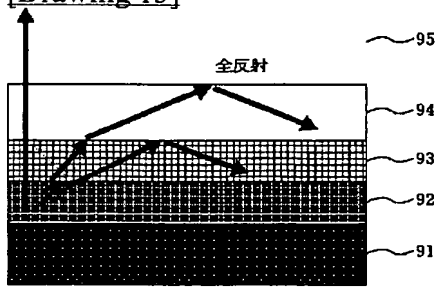




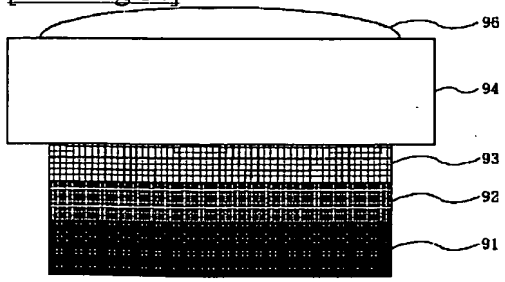
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]